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ABSTRACT

This review of research into the acquisition of grammatical coordination (i.e., the use of conjunctions) pulls together both English language and cross-linguistic data. Although the importance of pragmatic factors in language acquisition is not denied, the data make it clear that grammatical factors seem to play a significant role in the acquisition of coordination, and that pragmatic factors, if claimed to be independent of these grammatical factors, do not provide a viable alternative to either description or explanation of the acquisition of complex syntax such as coordination. (Author/JB)

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Coordination: The Role of Syntactic, Pragmatic and Processing Factors in its First Language Acquisition

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Introduction

This paper concerns the acquisition of a complex syntactic structure, coordination (i.e., coordination by the connective "and" in English). Our bibliography shows a listing of some of our earlier work on this problem. In this paper, we will discuss recent work which has commented on our earlier work from a different point of view.

General issues now pervade developmental psycholinguistics. Namely, to what degree is it necessary to postulate a developing grammatical competence in order to account for language acquisition; to what degree can principles of pragmatics or semantics provide an alternative account of this development? These issues are now being brought to bear on the question of acquisition of more complex syntax. In particular, a recent paper by Greenfield and Dent (at the Stanford 1978 Language Research Forum) attempted to formulate pragmatic principles to account for first language acquisition of coordination. Their paper deserves attention and comment, since it is one of few papers that tries to articulate a pragmatics-based model for acquisition of complex syntax.

Notably, the issue we must be concerned with is not whether children learn many cognitively complex pragmatic and semantic principles in order to become communicatively efficient (and interesting) with their language - there is no issue on this point; this learning is necessarily true and important. We need to be concerned with a more precise issue; that is, can the developing pragmatic and/or semantic principles in themselves explain the specific developing syntactic competence, without the need to invoke a separate developing grammatical competence. (Obviously this issue has deep implications for general issues in both psychology and linguistics: e.g., the independence of the language faculty from other forms of cognition, the autonomy of linguistic systems.)

Greenfield & Dent argue that certain pragmatic principles can account for certain specific facts regarding acquisition of coordination (in English). We will compare the proposed pragmatically-based model and a grammatically-based model for coordination. We will argue that a model limited only to pragmatic principles (and not including grammatical principles) does not provide a viable alternative explanation; and that a grammar-based model provides not only a possible, but a necessary account of the facts on acquisition of coordination.

The acquisition problem: Structure of coordination

Coordination is one of the principle devices for recursion and thus for infinite productivity in language. Examples 1-6 show basic examples of coordination such as we have used to test children in English (1-2), Japanese (3-4), and Arabic (Syrian) (5-6). As can be seen from these examples, coordination can connect either full sentences (as in the 'a' sentences) or it can connect other constituents (e.g., nouns or verbs), as in the 'b' sentences.

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1. Forward Reduction (in English)
   a. Dogs bark and dogs bite
   b. Dogs bark and ∅ bite

2. Backward reduction
   a. Birds sing and crickets sing
   b. Birds ∅ and crickets sing

3. Forward reduction (in Japanese)
   a. Inu-wa hoeru-shi inu-wa kamitsuku
      (Dog bark-and dog bite)
   b. Inu-wa hoeru-shi ∅ kamitsuku

      (Dog bark and bite)

4. Backward reduction
   a. Tori-wa naku-shi mushi-wa naku
      (Bird sing and cricket sing)
   b. Tori-to ∅ mushi-wa naku

      (Bird and cricket sing)

5. Forward reduction (in Arabic)
   a. bit-ganni ṭṭyūr w-bit-ganni ṣṣārāṣīr
      (sing(-she) the-birds and-sing(-she) the-crickets)

   b. bit-ganni ṭṭyūr w-∅-ṣṣārāṣīr

      (sing(-she) the-birds and -the-crickets)

6. Backward reduction
   a. btinbaḥ liklāb w-biteʕaḍḍ liklāb
      (Bark(-she) the-dogs and-bite(-she) the-dogs)

   b. btinbaḥ ∅ w-biteʕaḍḍ liklāb

      (Bark(-she) and-bite(-she) the-dogs)

As the examples show, complex processes of redundancy reduction interact with coordination. That is, the 'b' sentences with phrasal coordination may be viewed as resulting from reduction of redundant elements as shown by the zeros and the arrows. (n.b. Such gaps are often called 'anaphors' in current linguistic theory).

Any account of acquisition of coordination must account for how children learn to interpret and to produce such gapped (anaphoric) structures. Moreover, any account of acquisition of coordination must account for how children learn the proper constraints on these gappings in coordination. As the examples show, anaphora may work in either a forward or a backward direction. That is, a gap can either follow the term to which it is related (forward reduction) (1b is an English example); or the gap can precede the term to which it is related (backward reduction) (2b is an English example). Japanese and Arabic examples show that these languages also allow both forward and backward gapping in coordination.

In all these cases, the direction of reduction is not arbitrary. If a forward reduction is reversed to a backward, or a backward reversed to a forward, this most frequently produces an ungrammatical result. For example, 7 shows a reversal of the reduction pattern in 1.

7. *$\emptyset$ bark and dogs bite

Thus we can see how complex the acquisition problem is for the syntax of coordination. The child must learn not only an infinitely productive combining system, but the complex and highly constrained system of redundancy reduction which integrates with it.

Restated question in light of this acquisition problem

The question then becomes: Can a strictly pragmatics-based model account for the acquisition of this coordination system without including grammatical principles? We briefly compare the predictions of a pragmatics-based model to those of a grammar-based model.

Models for acquisition of coordination

Grammar-based model (Lust, 1977, in press(b); Lust and Mervis, 1980).

This model claims (i) that the child must acquire a relation between an unreduced coordination, e.g., a sentential coordination like 1a, "Dogs bark and dogs bite" and a reduced coordination, e.g., "Dogs bark and $\emptyset$ bite" where the redundant term "dogs" has been reduced. The grammatical model claims that in order to interpret (and also possibly to generate) a reduced (gapped) form children must have the competence for the full form, in order that the gap in the reduced form be interpretable. One might describe the relation between the full and the reduced form as a kind of transformation (e.g., a deletion transformation by which the gap is generated), but in current linguistic theory one might also describe it as a kind of mapping by semantic interpretive rule, by which the gap is interpreted. The distinction is not important for our purposes. Both versions claim a grammatical relation between the full and reduced form as part of language competence (see Lust, in press (b)). (ii) This model also claims that the child begins the development of productive coordination with certain general constraints. These constraints are determined by sensitivity to grammatical structure e.g., reduction direction, although they are more general and more strong than the adult language constraints. (iii) In this model development includes a weakening of the child language constraints, as the child learns to vary forms of redundancy reduction in accord with learned variation in the specific structure of its language.

Pragmatics-based model (Greenfield and Dent, 1979).

This model (i) denies that the child is learning a linguistic relation between the two coordination forms, gapped and nongapped. Elements are simply omitted in gapped coordinations, not reduced. What is omitted is old information. (There are some theoretical problems with the statement of these pragmatic principles but we will not go into those here.) The child maps directly from environmental context to the reduced form. Greenfield and Dent state: "Coordinate sentences are a direct linguistic representation of the perceived structure of the referential situation" (7). (ii) The pragmatic model recognizes that young children do not take all the options for possible coordination that adult language

allows, i.e., that child language is constrained. The pragmatic model explains this constraint in terms of principles of information theory, which are considered "pragmatics." (iii) It is not clear what development consists of in this model.

Acquisition data

The pragmatics-based model appears inconsistent with the available data on acquisition of coordination in English, while the grammar-based model appears consistent. For example, (1) there appears to be a developmental order in acquisitionof coordinate structures. Reduced (phrasal) coordinations (e.g., the 1b sentence) are not acquired productively until full unreduced sentential coordinations are acquired. Data from both elicited imitation experiments and natural speech support this. (Lust, 1977; Lust & Mervis, 1980; Bloom, et al., 1980; Limber, 1973; Slobin, 1975). Although this finding is consistent with the grammatical model it is not consistent with the pragmatic model, where children may simply "read" their reduced expressions off the referential environment, and have no need for the full form in their competence. (2) Children have been found in an elicited imitation task to map back and forth between full unreduced coordinations and reduced coordination: they not only reduce redundancy, e.g., in a sentence like 1a, to 1b, but they also elaborate a sentence where redundancy has already been reduced, e.g., like 1b or 2b, back to the full unreduced form (Slobin & Welsh, 1973; Lust, 1977; Theiman, 1975; deVilliers, et al, 1977). Such data although they are consistent with a grammar-based model, appear inconsistent with the pragmatics-based model. According to the pragmatic model, elaboration, for example, involves restating what is "old information," the exact opposite of what the pragmatic principle calls for.

We can see then that general facts such as 1 and 2 regarding coordination acquisition in English do not support a strict pragmatics-based model and are consistent with a grammar-based model. We'd like to consider the pragmatic model more specifically now in terms of a specific principle it has designed to account for a specific set of data in early acquisition of coordination showing that children's early forms of coordination are constrained.

Directionality constraint

A specific set of data in acquisition of coordination has been described under what has been called a "directionality constraint." Briefly, young children acquiring English reduce redundancy in a forward direction. They do not reduce redundancy in a backward direction (although adult language allows this). Thus they reduce from 1a to 1b; but not from 2a to 2b in an elicited imitation task, for example. And in their natural speech they evidence coordinations like 1b before those like 2b (Lust, 1977; Lust and Mervis, 1980; Tavakolian, 1977, Solan, 1979).

The pragmatics-based model claims that the directionality effect in child language can be described by a principle from information theory which states that:

"If the perception of redundancy motivates the reduction aspect of phrasal conjunction, then we would expect only one type, forward deletion... backward deletion is inconsistent with an explanation in terms of redundancy reduction because in backward deletion, an element is omitted on its

first potential appearance - while it is still relatively uncertain or new - then encoded in the second sentence when it should have become redundant or old (Greenfield & Dent)."

Greenfield and Dent also propose another pragmatic principle, a "perceptual grouping" principle, to account for backward coordinations when they occur: i.e., a coordination, e.g., "red and yellow," occurs when objects referred to by the terms "red" and "yellow" are physically grouped together in the visual referential situation. The perceptual grouping principle, however, is not empirically predictive regarding coordination structure (since it may apply in either a forward or backward reduction pattern); so we'll discuss mainly the information-processing-based directionality principle, which is predictive. (It predicts the directionality constrained coordination data in early child language.)

The pragmatics-based principle for the directionality constraint as opposed to the grammar-based principle, predicts that data should occur which do not occur in early child language coordination; and it does not predict data which do occur.

(1) Data which do not occur

Since the pragmatic principle is an a-grammatical principle, it predicts that children should reduce all redundancy forward (not just the types of forward redundancy reduction which the grammar allows). Thus it predicts that children should not only reduce redundancy forward in "Dogs bark and dogs bite" giving "Dogs bark and ∅ bite (e.g., 1a to 1b) which is grammatical, but that they also should reduce forward in cases like 2a. Thus, they would convert to a sentence which is ungrammatical in English; a split coordination. For example, "Birds sing and crickets sing" ⟶ "Birds sing and crickets ∅," which is ungrammatical in modern English. (Similarly: "John likes beans and Sam hates beans" "John likes beans and Sam hates ∅.") The data show that children learning English rarely make such ungrammatical reductions either in elicited imitation or in natural speech, while they frequently make the forward reductions, e.g., 1a to 1b, allowed by the grammar.

(2) Data which do occur

Data which do occur, but which are predicted not to occur by the pragmatic principle, include cross-linguistic data on acquisition of coordination. In our research, we have found real differences (systematic and consistent) in the way in which children reduce redundancy (in different directions) in different languages. Our data so far suggest that these differences correlate in a significant way with fundamental structural properties of those languages. Since the proposed pragmatic principles are independent of the structural properties of language, it would be difficult for the pragmatic model as stated to deal with these differences.

The data we are referring to here are provided by cross-linguistic tests we have done in languages other than English to study children's acquisition of coordinate structures like those we have tested in English. Table 1 shows examples of varied types of coordination sentences we have administered to young monolingual children who were learning Japanese (in Tokyo) or Syrian Arabic (in Damascus) as their first language. Groups of 30-40 children were tested in each language between 2-5 years

Table 1

The Elicited Imitation Task in Japanese and Arabic

Reduction Patterns of Simple Coordinative Sentences and Examples of both Sentential Conjunction and Phrasal Conjunction in Japanese (SOV) and Arabic (VSO)

Japanese (SOV) (Study #1)
(with Wakayama)

Forward reduction		Backward reduction	
i)	SV+$V	iii)	S¥+SV
ii)	OV+ØV	iv)	O¥+OV

Sertential conjunction	Phrasal conjunction	Sentential conjunction	Phrasal conjunction
ia) To-wa hiraku-shi to-wa Shimaru (Door open and door close)	b) Inu-wa hoeru-shi Kamitsuku (Dog bark and bite)	iiia) Tori-wa naku-shi mushi-wa naku (Bird sing cricket sing)	b) Sumiri-to tanpopo-ga saku (Violet and dandelion bloom)
iia) Mari-o tsuku-shi mari-o keru (Ball bounce and ball kick	b) Booru-o nageru-shi tsukamu (Ball throw and catch)	iva) Umi-o miru-shi yama-o miru (Sea look at and mountain look at)	b) Zubon-to seetaa-o Kiru (Pants and sweater put on)

Syrian Arabic (VSO) (Study #1 and #2)
(with Barazangi)

Forward reduction		Backward reduction	
i)	VS+¥S	iii)	V$+VS
ii)	VO+¥O	iv)	V¥+VO

Sentential conjunction	Phrasal conjunction	Sentential conjunction	Phrasal conjunction
ia) Katab ab wa-Katab tifl (Wrote (a) father and wrote a child)	b) Rakadh al-kalb wa-al quitt (Ran the dog and the cat)	iiia) La'ib al-akh wa-ghanna al-akh (Played a brother and sang a brother)	b) Akal wa-sharib al-ijl (Ate and drank the calf)
iia) Kul lahmah wa-kul khudar (Eat meat and eat vegetables)	b) 'Rkab al-hsan wa-al-mahr (Ride the horse and the foal)	iva) Zur Rabab wa-bus Rabab (Visit Rabab and kiss Rabab)	b) Ghsul wa-khayyet al-thiyab (Wash and sew the clothes)

old. (These were studies done with native speaker collaborators, Wakayama in Japanese and Hafez Barazangi in Arabic.) Coordination types in these sentences in Table 1 are like those tested in English, but show for example the difference in word order and other grammatical factors which characterize each of the languages.

Results of these studies show a remarkable similarity between English and Arabic coordination data with regard to direction; but also a remarkable difference in the Japanese results from either of these languages. Japanese children in fact strongly prefer a backward direction of redundancy reduction. That is, they find it significantly easier to imitate coordinations with backward reduction patterns e.g., example iiib or ivb on table 1 are significantly easier than ib and ii b. Arabic like English children prefer forward reductions. Moreover, Japanese children never (almost) reduce redundancy in a forward direction whereas both English and Arabic speaking children frequently reduce redundancy in a forward direction.

Clearly, the pragmatic information-theory-based principle of directionality predicts that data such as the Japanese data should not occur. It would have to claim that "new information" (as information has been defined in that model) is reduced by the Japanese and "old" information is retained (reversing the standard principle for English), or that Japanese chi dren are systematically more sensitive to "perceptual grouping" bot of which are unlikely results psychologically or anthropologically. Such systematically different results cross-linguistically would appear to seriously undermine any strictly pragmatic account of the acquisition data - since the foundation for the pragmatic-based proposal would seem to lie in general cognitive-perceptual principles of the human mind which would assumedly be universal. To the degree that these principles are <u>not</u> universal but in fact correlate with structural differences in the specific language being acquired, their general cognitive and a-grammatical nature is suspect.

These cross-linguistic results are in accord with a grammar-based model since we have defined reduction direction as closely linked to grammatical structure. In fact, English and Arabic are grammatically similar and Japanese is grammatically different from both English and Arabic in ways which we have theorized to be critical to the directionality constraint (Lust and Wakayama, 1979, in press; Lust and Barazangi, in preparation). The differences we have found across languages are in general consistent with a theory which claims that children's early forms of (anaphora) redundancy reduction may be constrained in all languages but the directional constraints are determined by the child to accord with basic structural properties of their language.

In conclusion, we do not want to deny the importance of pragmatic factors in language acquisition. However, it is clear from the data we have outlined here (both the English language data and the cross-linguistic data) that grammatical factors seem to play a significant role in children's acquisition of the syntax of coordinate structures and that pragmatic factors, if claimed to be independent of these grammatical factors, do not provide a viable alternative to either description or explanation of the acquisition of complex syntax such as coordination.

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